

A NOTE ON *NOTHYLAEUS HERALDICUS* (SMITH)
THE MEMBRANE BEE
(Hymenoptera: Colletidae)

J. S. TAYLOR

Port Elizabeth, Republic of South Africa

Among four species of solitary bees which have occupied artificial nests at Port Elizabeth is one belonging to the Colletidae, namely *Nothylaeus heraldicus* (Smith), otherwise known as the membrane bee, and perhaps the most widely distributed small bee in South Africa. Dr. S. H. Skaife in his "African Insect Life" (1954) gives an account of this bee and its habits which is largely confirmed by the observations of the present writer at Port Elizabeth. It is hoped that the following notes on the behaviour and habits of this bee at artificial nests at Port Elizabeth will be of interest, especially to those to whom Dr. Skaife's book is not familiar.

The adult bee is about three-eighths of an inch in length, and is reddish brown to black with red antennae and legs. The front of the head is pale yellow and there are two small stripes of the same color on the abdomen.

At Port Elizabeth this bee has twice used the artificial nests, once in April-May 1960 and again in June-July 1961. It has not hitherto been observed at the nest site during summer although it has been obtained from a beetle burrow in a pine stump in December. This autumn and winter nesting would appear to be at variance with its behaviour in the Western Cape where there are two generations per year, in October-November and in January-February, and where the larvae of the second generation, full-grown in April, do not pupate until the spring (Skaife, *op. cit.*).

N. heraldicus normally nests in any suitable opening such as hollow stems, holes in walls and the burrows of wood-boring insects. The artificial nests which it adopted at Port Elizabeth were glass tubes measuring three inches by three-tenths of-an-inch, the containers for cocaine as used by dentists, and also paper and cellophane cylinders of the same dimensions. The latter were found to be more satisfactory than the glass vials in which nests and their contents are apt to become infected by mould, with fatal results. The vials and cylinders were inserted in a small block of wood situated in an open-sided box on a north-facing windowsill. Four

species of solitary bees, the other three all belonging to the Megachilidae, have now used the artificial nests.

N. heraldicus was first observed at the nest site on 23 April 1960 when a female commenced nesting operations and continued thus until 2 June or possibly a few days later. No further sign of the species was then seen at the site until 1 July 1961 when a recently completed nest of three cells was found in a cellophane cylinder. The bee responsible (presumably) was noted constructing another nest in a paper cylinder a few days later and continued working until 26 July when it was last seen.

N. heraldicus has been well-named the membrane bee from the structure of its nest. It lines the adopted hole with a salivary secretion which dries into a thin transparent pellicle (Imms, 1957). One cell is thus constructed at a time. Invariably, but sometimes before and sometimes after the construction of the first cell, a transverse and horizontal barrier of the same transparent material is formed at a distance of approximately half-an-inch from the entrance to the nest and which has a small round hole in its exact centre through which the bee passes to and from the nest inside. When the base and sides of the cell have been completed the bee supplies it with a semi-liquid mixture of pollen and nectar, resembling, as remarked by Skaife, egg-yolk in color and consistency. He also mentions that the food is much more liquid than that of most solitary bees and that it would soak into the walls of the nest were it not for the waterproof membrane or pellicle. The bee brings the food to the nest in its crop and regurgitates it there, members of the Colletidae lacking the scopa or pollen brushes of the more advanced bees. The long and narrow cylindrical egg is deposited on the honey and the cell is then sealed off leaving sufficient space for the developing larva. A completed cell measures 7 to mm. in length but the first or basal cell may be up to 10 mm. long. The number of cells per nest had varied up to five. In 1960 the bee concerned made five nests containing a total of twelve cells complete with complement of food or honey. In 1961 the bee involved formed four nests, again with a total of twelve fully furnished cells. As Skaife points out, however, the female bee may continue nest construction after her ovaries have become exhausted, and it has been observed at Port Elizabeth that some cells, particularly the last to be made, are abortive although apparently containing the normal

amount of food. He also states that twelve to fifteen cells is the limit of capacity for one bee. When a nest has been completed it is sealed off at or just within the entrance to the hole or container with the same salivary secretion which resembles, to quote Skaife, "a thin sheet of mica."

The period occupied in cell and nest construction varies according to prevailing climatic conditions: in warm weather building may be at the rate of one cell per day but under cold conditions activity is greatly reduced and may cease altogether for the time being. An average of two days per cell would appear to be normal at Port Elizabeth during autumn and winter. On cold days the female bee remains inactive within the nesting hole with its head facing the entrance: it also spends the night in the same position and situation.

The incubation period at Port Elizabeth during July occupied 10 to 11 days—Skaife gives 5 to 10 days for the Western Cape. On hatching the larva lies in a curled position, resembling the letter, C, on the stored honey which it gradually consumes, after which it stretches out lengthways in the cell. The duration of the larval period at Port Elizabeth has not been determined but according to Skaife it occupies some two weeks. When full-grown the larva pupates in its cell—no cocoon is formed—and the adult emerges three to four weeks later, or about two months after the egg was laid. In the case of a nest constructed towards the end of May in Port Elizabeth adult progeny emerged on 26 August, after a period of approximately 96 days in the immature stages. Other nests, completed in June-July, produced adults from late September to early October after periods of some 90 to 97 days.

Hitherto, as mentioned earlier, *N. heraldicus* has been observed at the artificial nests in autumn and winter only when the duration of the various immature stages would normally be longer, hence the differences in this respect between Port Elizabeth and the Western Cape. It seems possible that nesting is continuous throughout the year at the former while the absence of this bee at the artificial nests there in summer may be due to the fact that these are then so much occupied by other species one of which is greatly given to interference in the nests of others. On the other hand if, as in the Western Cape, there are two generations per year, there must be considerable overlapping. Adults have been recorded

locally from April to July, September- October, and also in December.

The female of *N. heraldicus* is quick and jerky in its movements like a wasp, and it works rapidly smoothing with its tongue the silky gummy material which speedily hardens to form the pellicle. In this operation the tongue performs forward and sideways sweeping movements, the antennae and first pair of legs are also involved. Similarly, after the regurgitation of honey, it smoothes the latter over with up and down sweeping movements of the tongue. It may be absent on foraging trips for ten minutes or longer, while the deposition of honey in the cell occupies one or two minutes. The bee has also been seen pushing or working at the honey with the tip of its abdomen. This would continue over a period during which it frequently rubbed the tip of the abdomen with one of the third legs. In this cleaning operation the ovipositor was seen to be extruded slightly. It may have been at or about the time of actual oviposition as the cell concerned was observed being sealed off immediately afterwards.

If the nest tube or vial is at once removed on the return of the occupant from a foraging trip the bee may exhibit agitation and leave the cell in which it is working although not the actual nest. If undisturbed for a few moments, however, the bee will remain unconcerned when the vial is removed and will continue working, even if subjected to close scrutiny with a hand-lens and in bright sunlight.

The male of *N. heraldicus* has not been observed at the nests except at the time of emergence.

Skaife (*op. cit.*) also gives an account of *Gasteruption spilopus*, one of the ensign wasps and a parasite of *N. heraldicus* in the Western Cape. It deposits its egg in a cell of the bee and the subsequent larva feeds on the honey as well as on the egg and larva of the bee. It may thus destroy the contents of two cells before it is full-grown. There are two or three generations per year, and autumn-produced larvae winter as such, not pupating until the spring. It has also been obtained from other solitary bees.

During May 1960 a female ensign wasp was seen on more than one occasion examining the nest site at Port Elizabeth and also thrusting its long ovipositor into several of the nests, as well as entering one of them, posterior end first, and then entirely

disappearing within. On 11 August a male and female wasp emerged from a nest of *N. heraldicus*, after a period of approximately 100 days since the parasite was first noted at the nest site. This wasp was subsequently determined *Gasteruption caffrarium* Schletterer. Two friends of the writer, one in Grahamstown and one in Port Elizabeth, find this wasp commonly on their glassed-in verandahs. In the case of the Port Elizabeth verandah small bees nest in the grooves where the slats of the blinds are inserted. Early in February 1962 the Port Elizabeth friend with the glassed-in verandah, Mr. A. H. Mowbray, collected some of the bees nesting there and they proved to be *N. heraldicus*. This lends support to the view that this bee nests throughout the year in Port Elizabeth, and only uses the artificial nests in winter when there is less competition from other species.

In one instance the megachilid *Heriades freydessneri* Schletterer occupied a recently commenced nest of *N. heraldicus*. The latter had almost completed the first cell when it was taken over by a female of *Heriades* which proceeded to tear the fabric of the cell apart. The rightful owner, which offered no resistance, was shortly afterwards seen prospecting for a fresh site, and a little later it had started a nest in another vial. This same *Heriades* frequently interferes with and takes over the nests belonging to other individuals of its own species as well as the nests of the leaf-cutting megachilid *Megachile (Eutricharaea) gratiosa* Gerstaecker. *Heriades* is active at the nest site from August to April and its presence then in numbers, as has been suggested earlier, may account for the absence of *N. heraldicus* there at that time. It also seems possible that this bee is susceptible to interference.

ACKNOWLEDGMENT

The writer is much indebted to Mr. C. Jacot-Guillarmod, Albany Museum, Grahamstown, for the identification of *N. heraldicus* (Smith) and to Dr. E. McC. Callan, Rhodes University, Grahamstown, for the determination of its parasite *Gasteruption caffrarium* Schletterer.

REFERENCES

- IMMS, A. D.
1957. A General Textbook of Entomology (revised edition). London, Methuen & Co. Ltd. 886 pp.
- SKAIFE, S. H.
1954. African Insect Life. London, Cape Town, New York. Longmans Green & Co. 387 pp.